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Original Research Article

Effect of Growth Regulators on Quantitative Characters of Chilli (*Capsicum annuum* L.)

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A B S T R A C T

The present investigation was conducted during *kharif* season of 2012-2013 at experimental field of Agricultural Botany, Dr. PDKV, Akola. The experiment was laid out in Randomized Block Design with three replications and thirteen treatments of growth regulators. The study revealed that the seed treatment and foliar application influenced on the yield attributing character of chilli over control. The result exhibited that the growth regulators namely NAA and GA_3 foliar spray during flower bud initiation stage was found to be beneficial for increasing the plant height, number of branches per plant and stem girth over seed treatments compared to control. With regards to yield contributing character i.e. fruit setting percentage, fruit length, fruit girth, average fruit weight, number of fruit per plant, number of seeds per fruit, seed weight per fruit, and fruit yield per plant showed increase in foliar spray of NAA 40 ppm than all other treatment including control.

Keywords

Weeds, Herbicides, Weed control efficiency, Cane yield and seasonal sugarcane

Introduction

Chilli (*Capsicum annuum* L.) is one of the most valuable commercial annual spice crop grown in India, also it is an important vegetable crop. Being a crop of tropical and sub-tropical region, it requires a warm humid climate. Fruits are available in the market throughout the year, since chillies are produced in all the season in one or other part of the country. India grows the largest number of vegetable in the world and it is the second largest producer next only to China.

India is the only country rich in many varieties of chilli with different quality factors. The fresh and dried fruits of chilli contain phenolic acid compound "capsaicin" in the placenta which is responsible for the pungency in chilli. The bright red colour at the ripening stage is due to the pigment capsanthin. It is rich source of vitamin A and C. Chilli fruits having deep red colour, without pungency are used as paprika. A group of chemical known as plant growth regulators, plant hormones and growth inhibitors have found many practical controlling implication in growth and many other physiological activities and metabolic processes of the plants. The growth regulators or promoters like GA_3 and NAA stimulate vegetative growth and are involved in the initiation of cell division in the cambium. Plant growth regulators are considered as new generation of agro-chemicals after fertilizers, pesticides and herbicides to augment seed yield and

quality. The plant growth regulators are known to enhance the source sink relationship and stimulate the translocation of photo assimilates thereby helping in better retention of flowers and fruits. Besides this, the growth regulators have the ability to cause accelerated growth in plants.

It is well known that treatment with different growth regulator substances resulted in marked changes in growth and yield of different crops. The use of plant growth regulators is one of the most important tools in hands of agriculturists. It is well established fact that growth regulators exerts effect on cell elongation, the precise action depending on the concentration of the substances used and sensitivity of the organ concerned. The plant growth regulators are classified into different categories viz., Auxin, Gibberellins, Cytokinin, naturally hormone, ethylene, dormins, flowering hormones, synthetic growth retardant etc. With above consideration, keeping in view an experiment was planned on "Influence of growth regulators on yield and yield parameters of chilli (*capsicum annuum*) var. Jayanti "

Materials and Methods

The present study was undertaken at the experimental field of Agricultural Botany Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) during the Kharif season 2012-2013.The objective of present study was to study the effect of seed treatment and foliar application of plant growth regulator viz., NAA, GA_3 on physiological characters and quality of chilli var. Jayanti

The experiment was laid out in Randomized Block Design with 3 replications and 13 treatments. The gross plot size was 2.4 m x 6.0 m and net plot size was 2.4 x 4.8m. The transplanting of chilli crop was done on 14 August, 2012 with the spacing of 60 cm between rows and 60 cm between plants, respectively. During the crop growth, required package of practices were given as per the recommendation to each experimental plots. Intercultural operations were followed timely. The growth regulators i.e. NAA and GA_3 with concentration of 50 ppm, 100 ppm and 150 ppm each were used for seed treatments before sowing and the same growth regulators i.e. NAA and GA_3 with concentration of 20, 30 and 40 ppm each were applied as foliar spray at flower bud initiation after transplanting in chilli.

The observations taken on twelve different morphological characters along with yield contributing parameters in field. The observations were taken from five randomly selected plants, from each treatment and replication. The results obtained during the present study are summarized here as under.

Results and Discussion

Plant height is an important morphological parameter. Significantly more plant height was recorded by treatment T_9-NAA 40 ppm (54.67 cm) which was at par with T_{12}-GA_3 40 ppm (54.33 cm) and T_{11}-GA_3 30 ppm (54.00 cm) Kannan et al. (2009) reported that the greatest plant height was observed at NAA 50 ppm spraying at vegetative, flowering and harvest stages during winter and summer seasons. Based on the results, it can be concluded that NAA 50 ppm had increase plant height significantly.

The increase in plant height might be due to apical dominance effects of auxins. The growth regulators are involved in enhancing photosynthetic activity, efficient assimilation, of photosynthetic product and it resulted in rapid cell division and cell elongation in growing portion of the plant or stimulation of growth besides increasing uptake of nutrients (Pandita et al.1980).

Similar beneficial effect of growth regulators on plant height were reported in chilli by Daddlmani and Panchal (1989) and Revnappa (1998).

It was observed that the treatment T_9-NAA 40 ppm (3.17) has maximum number of branches per plant followed by T_8-NAA 30 ppm (3.10) over control (2.40). This may be due to the increase in the number of primary branches due to auxins attributed to the activation of cell division and cell elongation in the axillary buds which had promoting effect in increased number of primary branches and secondary branches.

Interaction with synthesis of native cytokinin present in the root cells and its transport at later stages to auxiliary buds, leads to the formation of more branches. Similar effect of growth regulators on number of branches per plant were reported in chilli by Kanan et al. (2009) and Kalshayam et.al (2011).

Days to 50 percent flowering varied among the growth regulator foliar application over seed treatment method. Significantly minimum (39 DAS) number of days required for 50 percent flowering in T_7-NAA 20 ppm (39 DAS) foliar application whereas, it was maximum (45.67DAS) in control. This may be due to the increased synthesis of cytokinin and auxin in the root tissue by their enhanced activity due to the application of NAA. Their simultaneous transport to the axillary buds would have resulted in a better sink for the mobilization of photo-assimilates at a faster rate. This has helped in the early transformation from the vegetative phase to reproductive phase. Kannan et al. (2009) reported that early flowering at NAA 50 ppm (38.80) days required for 50 percent flowering fallowed by NAA 25 ppm (41.00) days compare to control.

Stem girth is a morphological parameter. The difference in stem girth (cm) was found significant in T_9-NAA 40 ppm, T_8-NAA 30 ppm and T_{11}-$GA_3$30 ppm as foliar application. Significantly more stem girth was recorded by treatment T_9-NAA 40 ppm (0.63 cm) which was at par with T_8-GA_3 40 ppm (0.62cm) and T_{11}-$GA_3$30 ppm (0.62 cm). The influence of growth regulators has been shown to cause cell elongation or enlargement the cell division in cambium or other tissues, or stimulation of growth processes in meristematic tissues. Patil and Patel (2010) reported the increase stem girth (6.70 cm) by using NAA 40 mg/l found to be beneficial over control in okra.

In present study fruit setting percentage showed significant difference among all treatments. Showed that treatment T_9-NAA 40 ppm (44.11%) was found significantly highest followed by treatment T_8-NAA 30ppm (43.47%). The growth regulators like NAA, GA_3 are known to involve in inhibition of cellulose and pectinase activities and abscissin production which might have reduced the premature flower drop apart from involved in ovary development during seed filling process (Revanappa, 1998) in chilli Similar beneficial effect of growth regulators on fruit setting percentage were reported in chilli by Doddamani and Panchal (1989).

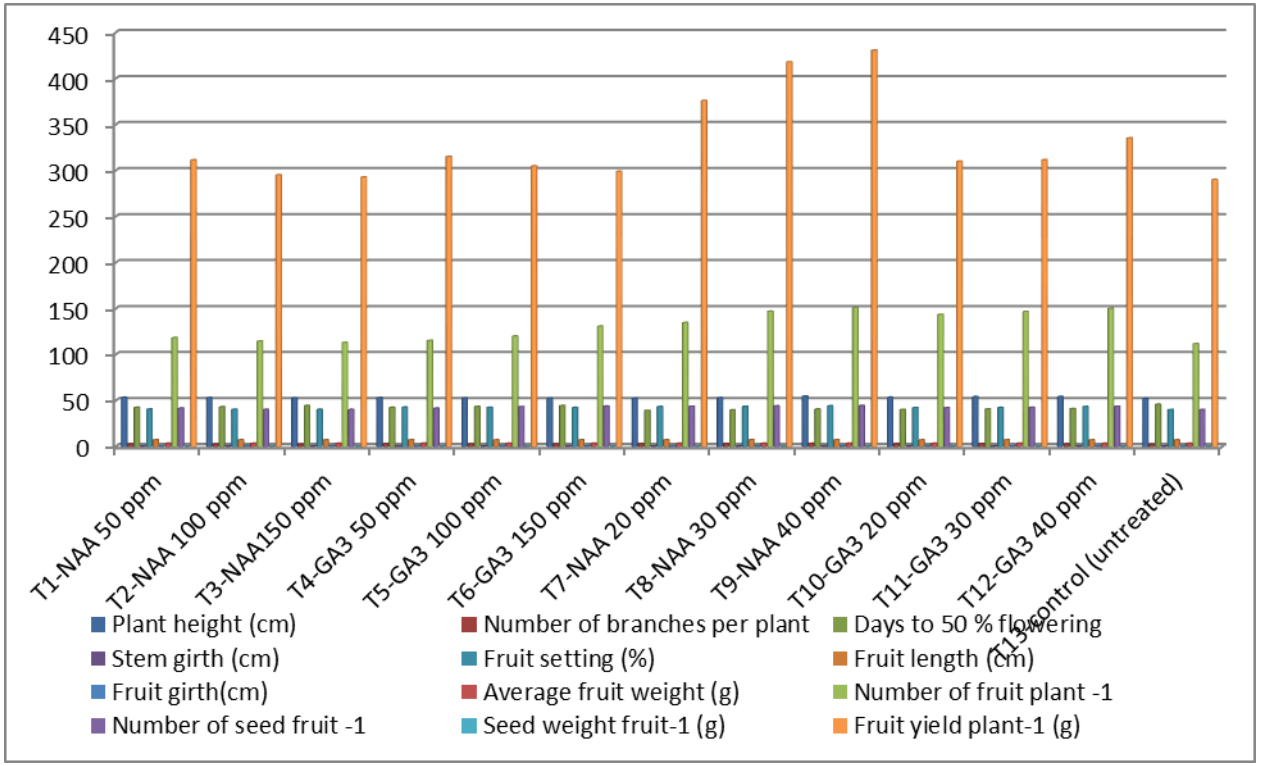
The difference in Fruit length (cm) was found significant in T_9-NAA40 ppm, T_8-NAA 30 ppm and T_{10}-$GA_3$30 ppm as foliar application over control. Significantly more fruit length was recorded by treatment T_9-NAA40 ppm (7.27 cm) which was at par with T_8-NAA 30 ppm (7.21 cm). This increase in fruit length may be attributed to increase in number cell as well as elongation of cells which is characteristic action of any auxins group of chemicals. Similar results were reported by Sharma et al. (1999) in bell paper.

Table.1 Effect of growth regulators viz. NAA and GA_3 on yield and yield contributing characters of chilli

Treatment	Plant height (cm)	Number of branches per plant	Days to 50 % flowering	Stem girth (cm)	Fruit setting (%)	Fruit length (cm)	Fruit girth(cm)	Average fruit weight (g)	Number of fruit plant $^{-1}$	Number of seed fruit $^{-1}$	Seed weight fruit^{-1} (g)	Fruit yield plant^{-1} (g)
T1-NAA 50 ppm	53.32	2.57	42.33	0.57	40.54(39.5)*	7.11	0.81	3.41	118.23	41.67	0.22	311.34
T2-NAA 100 ppm	53.03	2.47	43.00	0.56	40.33 (39.4)	7.10	0.81	3.40	114.47	40.20	0.21	295.27
T3-NAA150 ppm	52.65	2.43	44.33	0.56	40.26 (39.4)	7.10	0.80	3.40	112.87	40.10	0.21	292.73
T4-GA_3 50 ppm	53.03	2.93	42.33	0.58	42.72 (40.8)	7.11	0.80	3.41	115.10	41.50	0.22	314.97
T5-GA_3 100 ppm	52.67	2.80	43.33	0.57	42.49 (40.7)	7.10	0.80	3.41	119.93	43.17	0.22	304.83
T6-GA_3 150 ppm	52.32	2.70	44.33	0.56	42.29 (40.6)	7.10	0.79	3.40	130.63	43.73	0.21	298.97
T7-NAA 20 ppm	52.33	2.97	39.00	0.60	43.36 (41.2)	7.11	0.81	3.42	134.57	43.53	0.21	376.03
T8-NAA 30 ppm	53.00	3.10	39.67	0.62	43.47 (41.5)	7.21	0.82	3.43	146.87	44.03	0.23	417.83
T9-NAA 40 ppm	54.67	3.17	40.67	0.63	44.11 (41.6)	7.27	0.83	3.44	150.93	44.37	0.24	430.60
T10-GA_3 20 ppm	53.33	2.93	40.00	0.61	42.16 (40.5)	7.14	0.81	3.42	143.40	42.03	0.21	309.83
T11-GA_3 30 ppm	54.00	2.83	40.67	0.62	42.26 (40.5)	7.12	0.81	3.41	146.60	42.47	0.21	311.60
T12-GA_3 40 ppm	54.33	2.63	41.00	0.61	43.31 (41.2)	7.13	0.82	3.41	149.87	43.53	0.22	335.13
T13-control (untreated)	52.00	2.40	45.67	0.55	39.97 (39.2)	7.07	0.78	3.39	111.60	39.96	0.20	290.10
'F'test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE(m)	0.30	0.067	0.51	0.004	0.08	0.02	0.006	0.005	1.18	0.92	0.007	12.5
CD at 5%	0.86	0.197	1.51	0.012	0.25	0.06	0.018	0.016	3.43	2.67	0.021	36.4

(*)Figures in parentheses are $\sqrt{X}$ values.

Fig.1 Graphical representation of effect of different plant growth regulators on quantitative characters of chilli



Significantly more fruit girth was recorded by treatment T_9-NAA 40 ppm (0.83 cm) foliar application. This increase in fruit girth may be attributed to increase in number cell as well as elongation of cells which is characteristic action of any auxins group of chemicals. Kannan et al. (2009) reported that fruit girths (7.26 and 6.68 cm) were significantly influenced by NAA 50 ppm during winter and summer seasons.

Significantly more Average fruit weight was recorded by treatment T_9-NAA40 ppm (3.44 g) which was at par with T_8-NAA 30 ppm (3.43 g) and T_{10}-$GA_3$20 ppm (3.42 g). The average fruit weight is controlled by fruit length, fruit girth and number of seeds per fruit which all were higher in magnitude at T_9 NAA 40 ppm. Similar findings were noticed by Revanappa et al. (1998) reported that average fruit weight (2.60 g) in summer and (2.66 g) in kharif was highest in NAA 20 ppm foliar spray followed by lower concentration of NAA i.e. 10 ppm.

Number of fruit per plant is important yield contributing parameter. The maximum more number of fruit per plant was recorded by treatment T_9-NAA 40 ppm (150.93) followed by T_8-NAA 30 (146.87) ppm which was at par with T_{12}-GA_3 40 ppm (149.87) and minimum number of fruit per plant was recorded in control (111.60). Number of fruits per plant was recorded maximum under NAA treatment as compare to other. It might be due to photosynthetic activity as number of branches, number of leaves and leaf area was more. Similar findings recorded by Suryanarayans and Arifuddin (1980).

The difference in Number of seed per fruit was found to be significant the maximum number of seed per fruit was recorded by treatment T_9-NAA 40 ppm (44.37) which was at par with T_8-NAA 30 ppm (44.03) and minimum number of seed per fruit was recorded in treatment control (39.96). Biradar (1999) reported that in chilli the highest number of fruits per plant (131.74) were noticed with 20 ppm NAA was sprayed twice at flower initiation and 50 per cent flowering compared to control (92.54).

Seed weight per fruit varied among the growth regulators foliar application over seed treatment methods. The difference in seed weight per fruit was found significantly more was Seed weight per fruit recorded by treatment T_9-NAA 40 ppm (0.24 g) which was at par with T_8-NAA 30 ppm foliar application over control (0.20 g). Biradar (1999) reported that in chilli the highest seed yield per plant (53.39 g) and seed yield per hectare (622 kg) were noticed with 20 ppm NAA was sprayed twice at flower initiation and 50 per cent flowering compared to control (36.12 g and 434 kg, respectively).

Fruit yield per plant varied among the growth regulators foliar application over seed treatment methods. Significantly more fruit yield per plant was recorded by treatment T_9-NAA 40ppm (430.60 g) which was at par with T_8-NAA 30 ppm (417.83 g) in foliar application over control. The minimum fruit yield per plant was recorded in control (290.10 g). This might have resulted in higher photosynthetic rate adding in better shoot and root growth. Increase yield due to NAA application was, reported by Sharma et al. (1999) in bell paper.

These results are in accordance with Revanappa et al. (1998) reported that fruit yield per plant were obtained when 20 ppm NAA was sprayed after transplanting compared to control in chilli. Phookan et al. (1991) recorded the highest fruit yield (779.52 q/ha) in tomato with 10 ppm NAA and was on par with 20 ppm and 30 ppm but

differed significantly with 40 ppm compared to control (464 q/ha).

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